CONNECTIONS BETWEEN COGNITIVE BIASES, ERROR MANAGEMENT THEORY, AND USER EXPERIENCE DESIGN

Heli Motanpotra

Srishti Manipal Institute
of Art, Design and Technology
Human Centred Design
Dr Sanjukta Ghosh
November 5, 2023

ABSTRACT

This study investigates the correlation between cognitive biases and user experience design, seeking to comprehend how these biases influence user perception and error management during the design process. It delves into the theoretical foundations of cognitive biases and employs a quantitative survey to explore practical implications.

In an increasingly complex world, cognitive biases silently impact our decisions, with wide-ranging consequences across fields such as finance, healthcare, and politics. The study casts light on various cognitive biases, including confirmation bias and the halo effect, within the context of user experience and their integration into design. The research presents survey findings that provide valuable insights into the prevalence of cognitive biases and their effects on decision-making.

Through a comprehensive analysis, the study reveals that age plays a significant role in user behavior when using Google products and reading search results. It emphasizes the existence of cognitive biases and their influence on user interactions in the digital age. This research holds potential for shaping digital strategies and design elements, encouraging critical thinking and objective decision-making. Future research may explore interventions to mitigate these biases and develop tools to enhance user experiences, including feedback mechanisms and survey instruments.

Keywords: Cognitive bias, User Experience Design, Error Management Theory, Feedback mechanism, Google, Decision making.

INTRODUCTION

In a world teeming with information and choices, the human mind continually navigates a complex way of decisions. However, beneath the layer of rationality, cognitive biases quietly exert their influence over judgments, actions, and behaviours. These biases, often termed as heuristics, represent systematic shortcuts our minds employ to streamline the process of understanding the world, sparing us from expending excess mental effort. From confirmation bias to the anchoring effect, cognitive biases have long intrigued both researchers and practitioners due to their capacity to shape individual behaviour and exert comprehensive consequences across diverse domains, including finance, healthcare, and politics.

This research paper seeks to delve into the core of this phenomenon, aiming to unravel the complexities of cognitive bias within the realm of user experience design. By shedding light on how cognitive biases impact users and designers in their daily tasks, and by exploring the intersections of error management theory with user experience research and design, this study aspires to pave the way for the development of survey tools, feedback mechanisms, and features. These tools can aid designers in overcoming cognitive biases and mitigating risks associated with communication. To achieve this goal, the study commences with an exploration of cognitive biases in the context of user experience, followed by an examination of error management theory and its potential integration into user research and design.

LITERATURE REVIEW

In the early 1970s, Amos Tversky and Daniel Kahneman introduced the term 'cognitive bias' to describe people's systematic but seemingly flawed patterns of responses to issues of judgment and decision making.[1] Cognitive bias raises concerns about the impartiality that should ideally underpin decisions related to initiating, pursuing, or settling an examination process.[2] These biases in decision making, encompass a broad range of deviations from what is commonly considered purely rational judgment and decisions. In his 2011 book, Daniel Kahneman proposed a distinction between two modes of human thinking: fast thinking (System 1) and slow thinking (System 2). System 2 involves deliberate, conscious analysis and rational decision-making, while System 1 is quick, automatic, and often emotionally driven. System 1 serves as a background process, enabling us to handle most daily decisions efficiently. System 2, while more rational, requires time, information, and motivation. More than 100 cognitive, decision-making, and memory-related biases have been documented in the literature, and the research in cognitive and social psychology continues to frequently identify and delineate new biases.[3]

---

[1] A. Wilke, R. Mata, Encyclopaedia of Human Behavior (Second Edition), 2012
[2] Karie Davis-Nozemack, Blinding as a Solution to Bias, 2017
[3] Joyce Ehrlinger, "Decision Making & Cognitive Biases," *Research Gate*, (December 2016), DOI: 10.1016/B978-0-12-397045-9.00206-8

The **availability heuristic** describes our tendency to use information that comes to mind quickly and easily when making decisions about the future. The brain tends to minimize the effort necessary to complete routine tasks, favouring shortcuts in decision-making, particularly in probabilistic scenarios. Select memories stand out due to emotional resonance or alignment with cognitive processes.[4] Additionally, people treat the ease with which a value or event comes to mind as informative regarding its likelihood or frequency.[5]

The **confirmation bias** describes our underlying tendency to notice, focus on, and give greater credence to evidence that fits with our existing beliefs. It represents a cognitive shortcut employed in information gathering and interpretation, resulting from a preference for efficiency in the evaluation of evidence, leading one to seek information that aligns with one's existing beliefs. Additionally, confirmation bias can serve to protect self-esteem, as individuals tend to avoid information that contradicts their cherished beliefs.[6]

The **halo effect** is a well-documented social-psychology phenomenon that causes people to be biased in their judgments by transferring their feelings about one attribute of something to other, unrelated attributes.[7]

The **response bias** refers to our tendency to provide inaccurate, or even false, answers to self-report questions, such as those asked on surveys or in structured interviews. Social pressures, disinterest in the survey, and eagerness to please the researcher are all possible causes of response bias. Furthermore, the design of the survey itself can prompt participants to adjust their responses.[8]

The **negativity bias** is a cognitive bias that results in adverse events having a more significant impact on our psychological state than positive events. Negativity bias occurs even when adverse events and positive events are of the same magnitude, meaning we feel negative events more intensely. Researchers Paul Rozin and Edward Poyzman, have identified four elements that explain why negativity bias manifests itself: negative potency, steeper negative gradients, negativity dominance, and negative differentiation.[9]

Error management theory connects these cognitive biases to the concept that they might serve as adaptive strategies for managing uncertainties and minimizing costly errors.

[4] "Why do we tend to think that things that happened recently are more likely to happen again?", The Decision Lab, last accessed November 4, 2023, https://thedecisionlab.com/biases/availability-heuristic

[5] Joyce Ehrlinger, "Decision Making & Cognitive Biases," *Research Gate*, (December 2016), DOI: 10.1016/B978-0-12-397045-9.00206-8

[6] "Why do we favor our existing beliefs?", The Decision Lab, last accessed November 4, 2023, https://thedecisionlab.com/biases/confirmation-bias

[7] "The Halo Effect", Nielsen Norman Group, last modified November 9, 2013, https://www.nngroup.com/articles/halo-effect/

[8] "Why do we give false survey responses?", The Decision Lab, last accessed November 4, 2023, https://thedecisionlab.com/biases/response-bias

[9] "Why is the news always so depressing?", The Decision Lab, last accessed November 4, 2023, https://thedecisionlab.com/biases/negativity-bias

The subsequent statistical analysis employed the Analysis of Variance (ANOVA) technique, using age as the independent variable while assessing the dependent variables linked to specific biases. This analysis was conducted utilizing RStudio software. The independent variable, age, has a substantial impact on both the frequency of Google products and services usage and the extent to which individuals read the complete text of a Google search result before selecting it.

CONCLUSION

In this research, confirmation bias, availability heuristic, halo effect, negativity bias, and response bias, along with their implications for decision-making have ben explored. Employing a quantitative approach, the objective was to gain a deeper understanding of how individuals recognize and respond to scenarios and questions that induce cognitive biases. The results have unveiled several significant insights. The research has substantiated the presence of confirmation bias, availability heuristic, halo effect, and response bias within the studied population, underscoring the pervasive nature of these cognitive biases in everyday decision-making. In a broader context, it's vital to acknowledge that age, the independent variable under investigation, has a noteworthy and statistically significant impact on two specific aspects: the extent of Google product usage and the thoroughness with which individuals read the entire text of a Google search result before making a selection. This implies that as individuals age, their interactions with Google products and their engagement with search results undergo discernible changes. This data highlights the clear influence of age on user behaviour in the digital context.

Understanding the existence of these biases and developing strategies to mitigate them is essential for promoting critical thinking and objective decision-making. This knowledge also aids in the development of user experience design elements such as feedback forms and problem reporting features. Future research can build upon these findings by exploring interventions to mitigate these biases, manage communication related risks, and develop survey tools and feedback mechanisms for users.